

## Claims

1. A method for measuring the length of a person's (1) steps, in which method the distance covered (S) and the number of steps (N) used is measured, **characterized** in that in the method
- 5 – the distance covered (S) is measured by transit time measurement of sound frequency pulses (12a, 12b, 12c), in which the transit time is measured between the moving person (1, B) and a fixed point (A), and in which before measuring the distance covered
- 10 – a measuring time (M) (300) used for measuring the length of steps is determined, and
- clocks of a transmission means (11) and a reception means (10) of the sound pulses are synchronized, whereby the reception means (10) of the sound pulses know both the moments of reception of the sound pulses (12a,
- 15 12b, 12c) and the moment of transmission (300) of each sound pulse (12a, 12b, 12c), and that
- number of steps (N) taken during the measurement is measured by an acceleration transducer (48) carried along by the person.
- 20 2. The method according to Claim 1, **characterized** in that the means used for transmitting the sound pulses (12a, 12b, 12c) is a sound transmitter (11), which transmits sound pulses essentially in the frequency range of 1 000–2 000 Hz and that the means used for receiving the sound pulses is a sound receiver (10), which can receive and indicate a sound pulse transmitted in the frequency range used.
- 25 3. The method according to Claim 2, **characterized** in that the moving person (1) has the sound transmitter (11), which transmits (311–314) sound frequency pulses (12a, 12b, 12c), which are received (320–322) by the sound receiver (10) at a fixed point (A).
- 30 4. The method according to Claim 3, **characterized** in that the distance estimate (S) obtained by the transit time measurement of the sound pulse (12a, 12b, 12c) is corrected (321) by at least one of the following factors having an effect on the transit time of the sound pulse (12a, 12b, 12c): the height (H) of the sound transmitter, (the angle  $\alpha$ ), the temperature of the air, the direction of the wind (angle  $\beta$ ) or the speed of the wind.
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5. The method according to Claim 3, **characterized** in that after the measuring period, the sound transmitter (11) sends an ending pulse (330) of the step length measurement, which ending pulse is received (340) in the sound receiver (10) and in which the final distance (S) of the person (1) from the sound receiver (10) is calculated.

6. The method according to Claim 1, **characterized** in that the step length is calculated by dividing the measured final distance (S) by the number of steps (N) measured by the acceleration transducer (48).

7. The method according to Claim 6, **characterized** in that the number of steps (N) measured is transferred from the sound transmitter (11) to the sound receiver (10) through a wireless electric link.

8. A measuring arrangement for measuring the length of a person's (1) steps, which arrangement comprises means for measuring the distance covered (S) and number of steps (N) used, **characterized** in that in the measuring arrangement – the distance covered (S) is arranged to be measured by transit time measurement of sound frequency pulses (12a, 12b, 12c), in which the transit time is arranged to be measured between a moving person (1, B) and a fixed point (A), and in which before measuring the distance covered

- a measuring time (M) (300) to be used has been determined, and
- clocks of a transmission means (11) and a reception means (10) of the sound pulses have been synchronized, whereby the reception means (10) of the sound pulses have knowledge of both the moments of reception of the sound pulses (12a, 12b, 12c) and the moments of transmission (300) of each sound pulse (12a, 12b, 12c), and in which measuring arrangement

- number of steps (N) taken during the measurement of the length of steps is arranged to be calculated from acceleration pulses caused by the steps, measured by an acceleration transducer (48) carried along by the person.

9. The measuring arrangement according to Claim 8, **characterized** in that the means for transmitting the sound pulses (12a, 12b, 12c) comprise a sound transmitter (11), which is arranged to transmit sound pulses essentially in the frequency range of 1 000–2 000 Hz and that the means for receiving the sound pulses comprise a sound receiver (10), which can both receive and indicate a sound pulse transmitted in the frequency range used.

10. The measuring arrangement according to Claim 9, **characterized** in that the moving person (1) has the sound transmitter (11), which is arranged to transmit (311–314) sound frequency pulses (12a, 12b, 12c), which are arranged to be received (320–322) by the sound receiver (10) at a fixed point (A).

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11. The measuring arrangement according to Claim 10, **characterized** in that a distance estimate (S) obtained by the transit time measurement of the sound pulse (12a, 12b, 12c) is arranged to be corrected (321) by at least one of the following factors having an effect on the transit time of the sound pulse (12a, 12b, 12c): the height (H) of the sound transmitter, (the angle  $\alpha$ ), the temperature of the air, the direction of the wind (angle  $\beta$ ) or the speed of the wind.

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12. The measuring arrangement according to Claim 10, **characterized** in that the step length measurement is arranged to be stopped by a stopping pulse (330) sent by the sound transmitter (11).

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13. The measuring arrangement according to Claim 12, **characterized** in that after the reception of the stopping pulse (340), the sound receiver (10) is arranged to calculate the final distance (S) of the person (1) from the sound receiver (10).

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14. The measuring arrangement according to Claim 8, **characterized** in that the step length is arranged to be calculated by dividing the measured final distance (S) by the number of steps (N) measured by the acceleration transducer (48).

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15. The measuring arrangement according to Claim 14, **characterized** in that the number of steps (N) measured is arranged to be transferred from the sound transmitter (11) to the sound receiver (10) through a wireless electric link.

16. A sound receiver (10), **characterized** in that it comprises

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– a user interface (43) for inputting the initial information of the step length measurement and for presenting the measurement result of the calculated length of steps

– a sound frequency receiver (42) for receiving and indicating a sound signal of essentially the frequency of 1 000–2 000 Hz

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– a central processing unit (CPU), a memory and a clock function (41) for calculating the transit time of a received sound pulse and for performing the calculation of the distance (S) on the basis of that, and

– a power source (44).

17. The sound receiver (10) according to Claim 16, **characterized** in that the input of the initial information of the step length measurement, the determination of the transit time of the sound pulse and the determination of the length of steps on the basis of that and presenting the measurement result have been implemented by a program application saved in the sound pulse reception means (10).

18. The sound receiver (10) according to Claim 17, **characterized** in that it is part of a terminal of a cellular network.

19. A sound transmitter (11), **characterized** in that it comprises

- a user interface (47) for starting the step length measurement
- a sound frequency transmitter (46) for transmitting a sound signal of essentially the frequency of 1 000–2 000 Hz
- a central processing unit (CPU), a memory and a clock function (45)
  - for transmitting a sound pulse used in the measurement at the intervals of a certain delay ( $\tau$ )
  - for detecting the end of the time (M) defined for the measurement
  - for sending a measurement ending pulse
- a means (48) for detecting an acceleration peak caused by a step and for saving the number (N) of the acceleration peaks detected, and
- a power source (44).

20. The sound transmitter (11) according to Claim 19, **characterized** in that the delay ( $\tau$ ) used in the transmission of the sound pulse, the length (M) of the step length measurement time and the determination of the transmission moment of the ending pulse have been implemented by a program application saved in the sound transmitter (10).

21. The sound transmitter (11) according to Claim 19, **characterized** in that it also comprises a means for transferring the number (N) of the acceleration peaks by a wireless data transfer link to another device (10).

22. The sound transmitter (11) according to Claim 19, **characterized** in that it is part of a terminal of a cellular network.